

Remarks

This Amendment After Final is in response to the final Office action mailed October 28, 2009. A petition for two-month extension of time and payment (by credit card authorization) for the requisite fees are submitted herewith. In the event any additional fees are necessary, kindly charge the cost thereof to our deposit account No. 13-2855.

Amendments have been made to claims 11 and 18, and new claims 22 and 23 have been added, so as to still more clearly capture the claimed invention. Claims 1-10, 12-17, 20 and 21 (of which claims 12-17 and 20 were previously withdrawn) are hereby cancelled in an effort to advance the present application toward allowance.

Claim 11 has been amended to recite that the formation of the metal nozzle plate layer occurs subsequently to the formation of the plurality of distinct bodies of polymeric material. Basis for this amendment may be found in the application as filed, for example in the passage at page 4, line 21 of the specification. Claim 11 has been further amended to clarify that the electroforming is performed around the peripheries of the bodies of polymeric material so as to define at least in part the shapes of the apertures. Basis for this amendment may be found in the application as filed, such as in the passage at page 6, lines 4 to 6.

Claim 18 has been amended to recite that the step of forming a first plate of metal occurs “subsequent to said step of exposing and removing first photoresist material”. Basis for this amendment may also be found in the specification as filed, for example on page 4, line 21.

Claims 1-9, 11, 18 and 21 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner, US Patent No. 4,246,076 (Gardner) in view of Nakazawa et al., Japanese Patent Publication No. H06-206314 (Nakazawa). Claims 1-10 and 21 are now canceled, but with respect to the remaining claims, the Applicant respectfully traverses these rejections.

As in the previous Office action, the Examiner concedes that Gardner “may not expressly disclose forming a nozzle extending through the body”, but contends that Nakazawa teaches

forming a nozzle extending through a body and that therefore claims 1 and 18 are obvious in view of this combination.

However, as stated in the “Remarks” section of the amendment made on July 2, 2009 (see, in particular, page 8, last paragraph – page 9, second paragraph), and restated in more detail in the recent telephone interview between the Attorney for the Applicant and the Examiner (an Applicant’s Summary of which is submitted herewith), the Applicant respectfully submits that the Gardner and Nakazawa are technically incompatible and hence, the rejection on the grounds of obviousness in view of such a combination should be withdrawn.

To summarize, and restate the arguments against the technical compatibility of Gardner and Nakazawa: firstly, it is submitted that the two documents effectively teach the reader to use opposite masks during development of photoresist material; and secondly, it is submitted that the nozzle formation method of Nakazawa cannot be incorporated into the method of Gardner, since Gardner leaves no uncured photoresist material, despite such material being required in Nakazawa’s nozzle formation method.

Before setting out these arguments in detail, it is considered helpful to briefly discuss the disclosures of the two documents.

Disclosure of Gardner

Gardner discloses a method where suitably shaped polymeric posts are formed on a substrate.

Figure 1(a) (reproduced below) shows the curing of a first layer of photoresist. In this step, the area labelled 11 is cured by radiation 9.

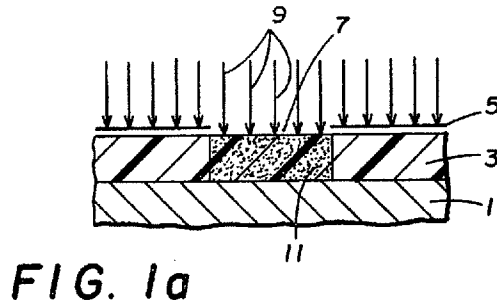


Figure 1(b) shows the curing of a second layer of photoresist. In this step, the area labelled 21 is cured by radiation 9.

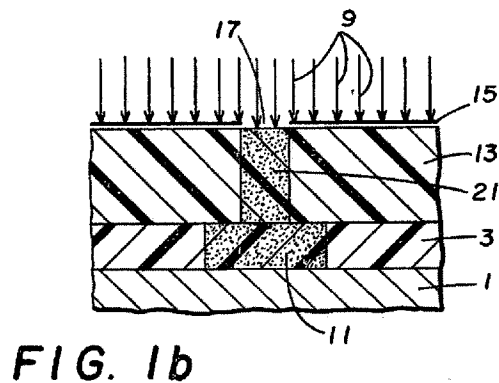
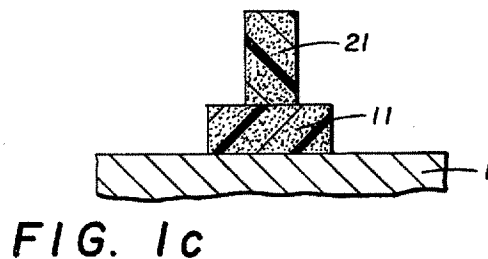
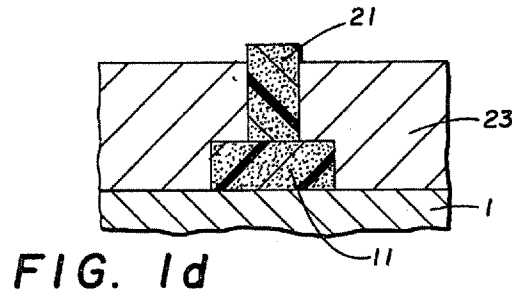


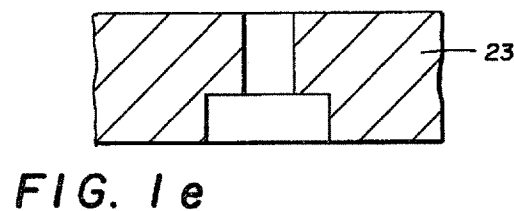
Figure 1(c) shows the removal of all uncured photoresist material, to leave only the portions 11 and 21 that were cured in the previous two steps.



Subsequently, a metallic material is electroplated around the post of cured photoresist, as shown in Figure 1(d).

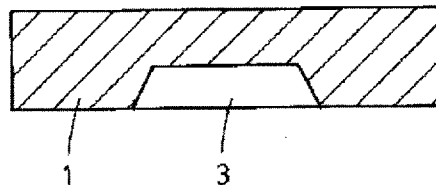


Finally, as shown in Figure 1(e) the metallic material is stripped from the substrate and the posts dissolved, so as to leave only the metallic layer 23, with a bore having a shape defined by the polymer post (11 and 21).

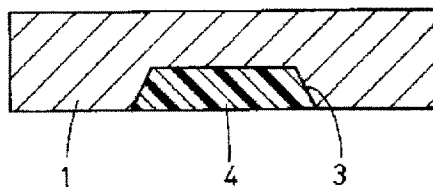


Disclosure of Nakazawa

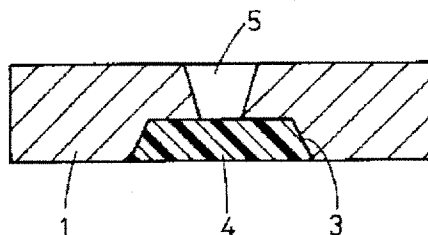
Turning now to Nakazawa, as is shown in Figure 2, a pressure chamber 3 is etched in one face of a substrate 1:



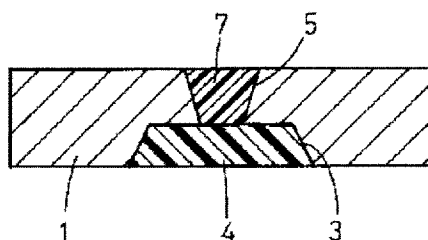
The pressure chamber 3 is then filled with filler 4, as shown in Figure 4:



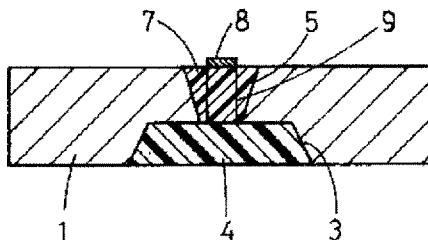
As shown in Figure 5, a hole (5) is then formed in other side of substrate 1:



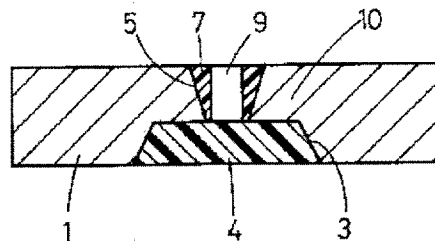
This hole (5) is then filled with photo-curing resin (7), as shown in Figure 6:



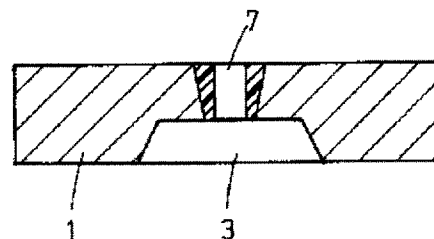
The portion (9) that will later become the nozzle bore is then masked using a mask (8), and the photo-curing resin exposed to radiation, as shown in Figure 7:



Then, as shown in Figure 8, the uncured resin is removed to leave a nozzle bore (9) defined by the portion of cured resin (7):



Finally, the filler (4) is removed from the pressure chamber (3), as shown in Figure 9:

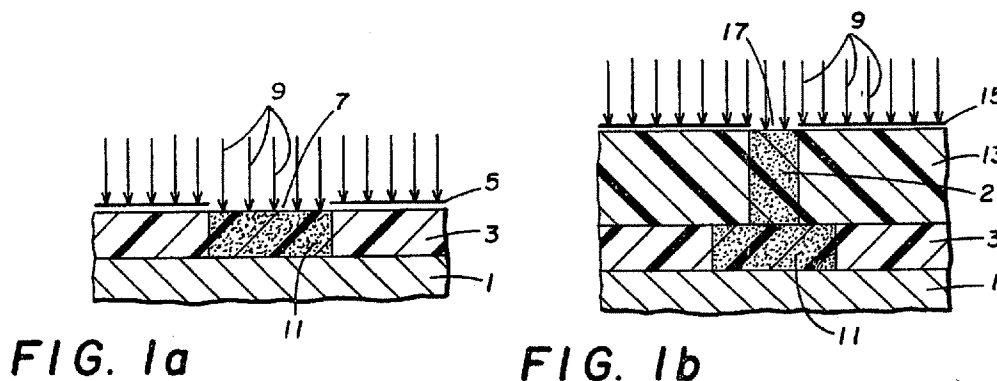


Comparison of Masks

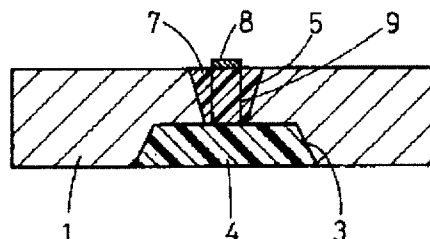
It is respectfully submitted that, at a very general technical level, the methods of both Gardner and Nakazawa rely on the masking and exposure of photoresist material to define the shape of a nozzle bore. Indeed, it will be appreciated from the above summary that without these masking and exposure steps the teaching of Gardner and Nakazawa is rendered meaningless: Without this step, Gardner simply discloses producing a metal plate, while Nakazawa discloses a substrate having a hole filled with uncured resin.

Thus, it is considered that any combination made of the teachings of Gardner and Nakazawa must combine the masking and exposure steps of both methods. However, as will be explained below, such combinations are unworkable since the two methods teach the use of inverse masks.

In Gardner, as may be seen in figures 1(a) and 1(b) for example, all the photoresist material is masked, except that which will later define the nozzle bore. In this regard, attention is drawn to the shapes of masks 5 and 15:



The shapes of these masks should now be compared to the mask (8) that is used in Nakazawa, where only the portion that will later define the nozzle bore is masked:



Clearly, therefore, the two methods teach the use of inverse masks.

Thus, if these two inverse masks were applied simultaneously, the combination would result in the masking of all photoresist material. Accordingly, subsequent exposure would cure no photoresist and no nozzle bore shape would be formed.

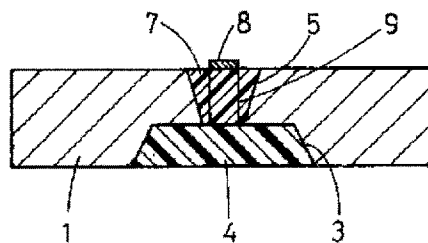
Alternatively, if the masking and exposure steps were applied separately, one after the other, all of the photoresist material would be cured. For example, the steps from Gardner would mask everything but the portion to become the nozzle bore, so that the photoresist corresponding to the nozzle bore becomes cured. When the mask from Nakazawa is later applied, the previously cured portion of photoresist is covered and so the remaining photoresist would be cured, thus curing all the photoresist material. It is simple to see that applying the mask from Nakazawa first and Gardner second produces the same result.

Thus, for the reasons presented above, it should be apparent that the use of inverse masks in the methods prevents any combination being made of Gardner and Nakazawa.

Gardner lacks uncured photoresist for use in method of Nakazawa

Turning now to the second argument against the technical compatibility of the documents, it should firstly be noted that the nozzle formation method of Nakazawa relies on the curing of photoresist material. This is clear from the discussion of figures 6-8 above.

For example, in Figure 7 (reproduced below), a mask 8 is placed over the portion that will later become the nozzle bore 9. The resin around the nozzle bore is then cured.



Thus, the nozzle bore in Nakazawa is formed by curing photoresist. As a result, to make use of the method of nozzle formation taught by Nakazawa, at least some uncured photoresist is required.

However, it should be apparent from the discussion of Gardner that all uncured photoresist material is removed in the step shown in Figure 1(c).

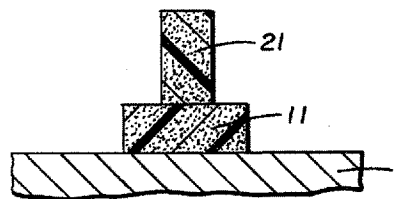
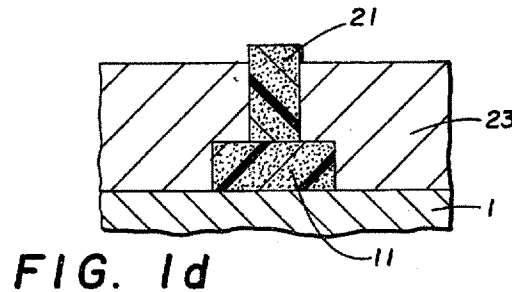


FIG. 1c

What remains after the electroplating step of Figure 1(d) is a post of cured photoresist (11, 21), and a surrounding metallic layer 23:



Thus, since there is no remaining uncured photoresist, the nozzle formation method of Nakazawa cannot be incorporated into the method of Gardner and therefore the two methods are technically incompatible.

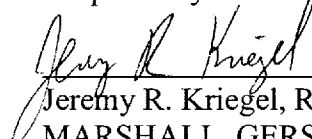
Conclusion

For at least the reasons presented above, Gardner and Nakazawa are not technically compatible and it is therefore respectfully submitted that the Examiner's rejection on the grounds of obviousness in view of a combination of these two references should be withdrawn. Entry of the present Amendment After Final and the Examiner's favorable reconsideration are respectfully solicited.

For at least these reasons, it is most respectfully submitted that claims 11 and 18, as amended, are patentable. Further, it is respectfully submitted that claims 19 and new claims 22 and 23 are patentable at least by virtue of their dependency on an allowable base claim.

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Respectfully submitted,


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